

2ND GENERATION API SYNTHESIS CONTINUOUS MANUFACTURING WITH HALF OF THE UNIT OPERATIONS

Continuous manufacturing offers an interesting toolbox for process intensification of API manufacturing processes. Flow Chemistry provides a wide range of fascinating processing options beside the "classics" of micro reaction technology/flow chemistry, like fast exothermic reactions and hazardous chemistry. An optimization of mass and heat transfer can reduce the necessary processing times by a factor of up to 10. By addressing the specific needs of a chemical reaction using specific reactors, by-product formation can be significantly reduced.

The consequence of a reduced by-product formation is reduced work-up effort. Blocks of three to four synthesis steps can often be executed without separation and work-up.

- Shorter processing times by a factor of up to 10
- In one project the number of unit operations was reduced from 18 to 9
- The number of solvents for four key steps was reduced from 14 kg solvent per kg of product (2 of them chlorinated) to 7 kg solvent per kg of product (using only chlorine-free solvents)



These efficiency-boosting projects pay for themselves by the sheer reduction of working capital, since the number of materials in process can be dramatically reduced. Continuous manufacturing enables a reduced variability of batches. Quality losses can be reduced by the use of PAT tools. Safety is increased by much smaller reactor volumes and a much better process control that can be achieved. Hazardous reagents can be generated in-situ and do not need to be stored. Microinnova offers the development of new process concepts by keeping the synthesis route.